PYROTECHNICS 46

The Now & Then Newsletter of General Technics

QUEST FOR THE BLUE UNICORN??

Clyde R. Jones

Well, it's not red. It's not amber. It's not yellow. And it's not really green. But is it blue? Or blue enough?

Ever since Light Emitting Diodes came out, I have been fiddling with them. I received my first ones from Poly-Pak at the end of the sixties, red non-diffused jobs with metal bases like transistors. Bright little point sources. I still have them, and they still work. I was clocking them with flip-flops made with discrete transistors.

But they weren't blue. I really wanted blue, a good Cherenkov blue. Deep and menacing, the better to build blinkies with. But all I could get was red.

A bit later (I'd survived Viet Nam, mostly, and a few things after that) I acquired some dim yellow LEDs. They were nice, providing a contrast with the red ones, but they still weren't blue. Any Time Now, the periodicals kept saying. By this time I had a whole slug of different red LEDs, in slightly different colours, and a lot of different packages, and I was driving them with power hog TTL chips and 555's. But they weren't enough.

Later still, I added green, then amber LEDs to the blinkie brigade, driving them all with highly efficient CMOS circuits, using the occasional darlington NPN booster. I'd even added a few bi-colour units, the red/green and amber/green types which did nice things with the source/sink capabilities of CMOS. But still no blue.

Oh, the literature still mentioned the Quest for the Blue Blinkie, now undertaken by this company, or that. They mentioned that blue LEDs were vital to flat screen T.V.s - the missing part of the RGB triad we were all so familiar with from out home sets and then rare colour monitors. They predicted they would be available Any Time Now. And still I waited.

Then the day came that I spotted the announcement in Electronic Parts and Design magazine. "Monsanto announces availability of BLUE LEDs!" The fine print mentioned the price: Fifty Four Dollars. Each. In Large Quantities. I asked them, anyway. Samples? Sure. Sixty Four Dollars. Each. In singles. Right.

Before going any further, and blowing the month's rice and bean budget, I asked about life expectancy. Well...they didn't really want to talk about that. Well...I did. Well, if I were careful, they were almost sure I could get a couple of hundred hours out of them. Maybe.

Right.

By now I had a couple of LED display units that had been running for almost 90,000 hours continuously, on line current downverted by some surplus power cubes. I went back to playing with my new 2 candella LEDs, still driving them with 4011's and a darlington pair. And waited.

Then, the mini-deluge. LEDtronics had Blue LEDs! CREE Research had Blue LEDs!

I inquired. Again.

LEDtronics would like to send me some samples, but there were problems, said the sales rep. So I talked to the head of the company. He could sell me some "production units" at full price, but no freebies. And he'd really rather wait. They were redesigning the dice, again. They kept exploding, or something. But they should have the problem taken care of eventually. Wonderful.

CREE Research was a bit more straight forward. No free samples, and they were working out some minor bugs. Like exploding dice? No answer. But soon...

I went back to my 5 Candella red LEDs which made some really great ray gun mock ups. They also were excellent for faking up laser designators.

Hewllet Packard began advertising their new line of Superultrabrights. Up to 30 candella. I sent for a sample. I got a flashlight. An LED flashlight. Free. One hell of a way to say "Yup. They're bright." I began converting small penlight units to use Superultrabrights for friends that were hunters or campers. LEDs are damn efficient compared to light bulbs, and the pure red colour doesn't ruin your night vision. No one was worried that the LEDs weren't as bright as krypton bulbs. Getting ten or twenty times the operating life was worth the loss of intensity.

Then I saw a small ad from Marktech International. Blue LEDs, available now, call (518) 786-6591. I called. The nice man asked how many I wanted, and what packaging. Water clear? Diffused? Seven segment displays? Five by Seven dot matrix displays? Oh, sorry, the 5x7's were due next month. All the rest were IN STOCK for shipment. Cost? Starting at $15 for singles,

appropriate price breaks for quantities. Sorry, no freebies. Part #MT1018D-BL for diffused, or MT1018-BL for clear.

Then I asked about operating life. Usually, this is the kicker.

Each unit, I was told, is burned in for FIVE HUNDRED hours at the factory before shipment. The survivors are shipped to the U.S. warehouse where they are burned in again for another five hundred hours. Those survivors are shelved and sold. I was told that by the time the LEDs had survived all this, they were expected to last for a hundred thousand hours or so without problems. O.K.!

I ordered two. They arrived UPS COD in a few days. Without data sheets. With slightly mangled leads. Sloppy packing. Great. I called to ask why no specs and got an apology, and an offer to FAX them to me. I don't have a FAX. He promised to mail them.

Not one to be daunted by little details, like having no idea of the maximum drive current or voltage, I didn't wait. I dragged the little things into my lab and began applying power to them. I am pleased to report that they happily survive 17 mA from a Radio Shack 9V battery delivered via a 220 ohm resistor. They are not overly bright, but they are quite noticeable. And they are not exactly blue. They are light blue, or maybe blue white. They are about as much bluer than daylight fluorescents as those are bluer than 100 watt incandescent lamps. Noticeable in direct comparison. But not deep blue. The ad says 470nm 'true blue'. I'm glad they think so.

The missing spec sheets arrive, along with my third complete set of catalogs and selection guides. They are shown to have a wide spectral output, with a Spectral Line Half Width of 70 nm which puts them well into green at half peak power! No wonder they are blue-white. At 20 mills they are supposed to be putting out 3.5 to 5.5 mcd. They melt if pushed beyond 50 mA, continuous. They can be filtered to produce deep true blue, but that drops their peak delivered power to a couple of millicandella. Now, how hard can I pulse them? They do not list a peak pulse current.

Then more good news, LEDtronics sends me a new (preliminary) data sheet for their offerings, and CREE has a 1/4 page add in the latest Electronic Engineering Times (July 16, '90), as well as a nice article in the 'new products' section. And a new toll-free number. I call and am told that I am on their computer list, and should be getting their new data sheets almost immediately in the mail, complete with a 'free sample request card'! Oh, goody. The nice lady, Janet Lewis, also mentions that CREE makes the dies for Marktech. Ah ha. That explains how CREE can offer discrete die for about $0.75 in large quantities. Now who do I know with a wire bonder??? I set back and eagerly await the new mailings.

Unfortunately, there is little hope of using these to make simple or cheap flatscreen RGB displays. All other colours of LED are fabricated from Gallium Arsenide or Gallium Arsenide Phosphide. Multi-colour arrays on a single substrate are possible by selective growth and doping, if you are content with Red, Amber, Yellow, and Green. That simplifies manufacture; all the pieces can be grown in place on one piece of material, at one time, like giant memory chips. But if you want to use blue, you have got a problem.

Blue LEDs are fabricated from tungsten carbide. The hard stuff that better drills and cutters are made from. Very hard. Very brittle. Hard to bond to. And not terribly compatible with Gallium Arsenide substrates.

If you are happy with the thought of fabricating RGB displays pixel by colourful pixel, and don't mind bonding each and every little colour dot separately, you can make RGB displays with LED chips. If you are subtle, and make all the control circuitry, as well as the red and green pixels from GaAs on one substrate, and then bond on all the blue ones later you might save a lot of work and cost. Or you might just go nuts from thermal differential incompatibilities in the bonding process, or other problems as yet undiscovered. Affordable flatscreen RGB LED displays are still a ways off.

Yeah. I now have real BLUE LEDs. Well, kind of blue. More blue-white. But I have them. And more are on the way. I am looking forward to more neat samples.

MARKTECH INTERNATIONAL CORP.
5 HEMLOCK STREET
LATHAM, NY 12110
PHONE (518) 786-6591
FAX (518) 786-6599
($15 for clear or diffused T-1 3/4 units in single quantities, shipping right now.)

CREE RESEARCH, INC.
2810 MERIDIAN PARKWAY
SUITE 176
DURHAM N.C. 27713
PHONE 1-800-LED-BLUE (cute, that) ask for Janet Lewis or Mr. Hunter
FAX (919) 361-4630
(CREE quotes the lowest prices for their blue LEDs, and the widest variety. They also sell the discrete die for as little as $0.75 in quantity. I hope I can actually acquire some of their LEDs soon. They do seem like nice folks.)

LEDTRONICS, INC.
PHONE (213) 549-9995
FAX (213) 549-4820
(Still quoting 'preliminary specs' and 'sampling non-production samples only' at prices from $15 to $30 for T-1 3/4 units.)

Quarks

• Carol and Jeff Duntemann visited Chicago recently, and told us about the new magazine they've launched. *PC Techniques* is aimed at the technically-oriented PC user; whether you're a beginner or an expert, if you're interested in all the gears and wheels turning inside your PC and its software, this is the magazine for you. "We're targeting the self-taught (rather than university-taught) programmer," says Jeff. "It's very practical in nature; theory does not belong without practice."

PC Techniques
3202 E. Greenway
Suite 1307-302
Phoenix, AZ 85032-9941
Bimonthly, $21.95 for one year, $37.95 for two in the U.S., $29.95/year in Canada, $39.95/year foreign.

If you've followed Jeff's career as an editor for *PC Tech Journal* and *Turbo Technix* (and, of course, *PyroTechnics*) and a columnist for *Dr. Dobb's*, you know his skill at turning out a quality magazine that's interesting and useful to the computer techie. And you'll dash out and subscribe immediately. This is Carol's first job as Circulation Manager, but we are sure she'll do well. She has always managed to get our circulation going in the past.

• Terrorists Rose Geier and Tim Zahn went up against the Urbana Police Department SWAT team not long ago. Well, they're not full-time terrorists; Rose is a building inspector and Tim writes SF. But when the police needed help in a training exercise, they became hardened criminals for a morning. In the first scenario, Tim played a dangerous fugitive holed up in an abandoned house. Police collard him relatively quickly. Then Rose became a desperate animal-rights advocate threatening an innocent veterinary-school lab tech (Tim). Her demands: Free the thousands of chickens held captive in the University of Illinois's research facility, and declare the city of Urbana an "animal-research-free" zone. She managed to give all branches of the SWAT team, from negotiators to snipers, a real workout before officers concealed in a closet captured her. Even then she nailed one with her paint-pellet

gun—but at least Tim was unharmed. Critics hailed it as a bravura performance. The chickens, however, are still penned up.

• Roller-Coaster Laboratory: Our friend Nathan Unterman teaches high-school physics, and has found the various rides in amusement parks to be excellent demonstration devices. So (like many physics teachers) he takes his students to the parks, where they measure accelerations and angles on a variety of rides. Nate's collected the experiments, lessons, and questions he's devised into a book called *Amusement Park Physics.* He covers dozens of rides, and even includes material to persuade your principal to let you take your class on a field trip! *Amusement Park Physics* is $18.95, book number 01-6071-K2, from:

J. Weston Walsh
PO Box 658
Portland, ME 04104-0658
(800)341-6094

• You may have heard about Lunar Prospector, the private effort to launch a probe to orbit the Moon's poles. It will produce a geochemical map of the entire Moon, showing the distribution of mineral resources. The spacecraft will also be capable of detecting ice deposits in shadowed cold traps near the lunar poles—a boon to any future lunar economy, if they exist. Design of the probe by Omni Systems is nearly complete, and NASA has agreed to donate a spare space-qualified gamma-ray spectrometer to the project. The Space Studies Institute, which is managing the project, has joined with other space activists in fundraising efforts. Peter Kokh reports that "Lunar Prospector Team Member" embroidered patches and caps, in snappy red, white, and blue, are now available. The LP logo features a lunar crescent and polar orbit over (naturally) crossed pickaxe and shovel. A donation of $5.00 or more gets you a mission patch. Look for them at Windycon, or order them from:

Milwaukee Lunar Reclamation Society
P. O. Box 2102
Milwaukee, WI 53201

(Checks should be made out to M. L. R. S. Peter asks that you please include a self-addressed stamped envelope.)

• Another former editor of *Pyro*, Lee Hart, has moved to Holland and bought a house. Don't ask him to send you wooden shoes, though—it's Holland, Michigan, previously famous as Cap'n Al Duester's hometown before he went to sea. Lee's new address is 323 W. 19th St., Holland MI 49423, phone (616)396-5085. He writes: "Went to the Dayton Computerf— er, Hamfest. Didn't see any techies, and it seemed like all the junk was the same as last year. Is there some secret rule that no new scrounge is allowed?"

Dubious Kluge Award

An item in the June 15 issue of the Chicago *Reader* relates the story of Dave Ten Eyck of Anniston, Alabama, whose pickup truck had a blown fuse. Ten Eyck didn't have any spare fuses, but he did have a .22 caliber rifle bullet, which, he noticed, fit the fuse socket perfectly. The improvised repair worked fine until the electrical current heated the bullet enough to make it go off, shooting Ten Eyck in the knee. *[BG]*

Frank Bynum

Part I

At the beginning of August 1990, the hot item on newspaper front pages was the invasion by Iraq that successfully took over Kuwait. [1] At issue were large outstanding financial debts of Iraq to Kuwait and other nations. Iraq angrily charged its neighbor with policies leading to unsatisfactorily low petroleum wholesale prices. Capture of Kuwait permitted Iraq direct ownership for 20% of the current world petroleum reserves.

It appeared that Saudi Arabia, with its rich oil fields might be next for an attractive forced acquisition. US, Japan, Europe, and many other regions depend substantially on the continuing availability of that region for their oil import needs. They made their concern known through diplomatic measures, including decisions to impose for economic sanctions against Iraq. A few of them sent an increasing naval presence into the area. In an announced response to Saudi request for assistance, the US send a major contingent of air and ground forces to Saudi Arabia. It was said to be the largest deployment of these forces by the US since the war in Indochina. [2]

Iraqi foreign ministry spokesmen said that nationals of Western nations would be held in detention. They would be permitted to leave only when military preparations, aimed by those outsider nations against Iraq, were pulled back from that region. Those persons were to be taken to be housed at various important civil and military facilities. The Some have interpreted this move to indicate an intention to use the detainees as human shields to dissuade attacks against key facilities. There are over 2500 UK and 3000-4000 US citizens affected. [3]

With these events, interest in Iraq's weapons capabilities, including high-tech weapons, which were of concern before summer started, rises even further.

Iraq-Bound Shipments Seized

In early 1990, there were various reports about apparent attempts by Iraq to circumvent the international embargo against sales and shipments of arms-related materials, to which it and Iran were subjected. These were still in effect from the period during the Iran-Iraq war. The

reports indicated customs, export control, and national security officials in certain European countries and the US were uncovering cases involving illegal export of munitions supplies and technology items to Iraq (among others). [4]

During April, news accounts appeared in which UK officials told of intercepting a man attempting to take special tight-tolerance capacitors to Iraq. These were of the type needed for generating very precisely timed electronic pulses. The task is critical for properly synchronizing an array of detonators, when a nuclear fission explosive relies on the implosion method. An Iraqi spokesmen demanded an apology for a "slanderously false smear champaign" by the British.

In the week before Thursday, April 19, 1990, UK customs confiscated a piping shipment being exported to Iraq. The seizure was widely reported, including items in the radio program *All Things Considered* on National Public Radio. Early statements from UK officials described their action as being due to the customs agents determination that the shipment would be used for a major military application. Those interviewed first were not giving many particulars. Iraqi spokesmen continually denied any purpose other than the original description: "components for petroleum operations." One of the interviewees was a staff member of a British firm which manufactures cannons. He expressed doubts about the Customs Office claims. He said the reports mentioned piping which had flanges at the ends. This is not common practice for making artillery.

That comment about "flanges" was suggestive of something I had encountered in previous readings. In the proceedings of a 1969 conference, [5][6] there was an article about the High Altitude Research Project—the use of cannons for boosting instrumented probes that performed upper atmosphere measurements. (Some designs had cannon tubes joined end to end.) Another book on sounding rockets further discussed that technology, including its potential applicability to boosting satellites into orbit. [7] With the clues from these sources, I wondered whether this meant someone else had decided to revive the HARP project. A bit later, on the 18th of April, *All Things Considered* reported additional news on the subject. [8] More details of the officials' theory were revealed. In the interviews, some of then spoke about gun characteristics likely to apply to the Iraqi effort. The precedent of the World War I "Paris gun" was mentioned, notable for its 70 mile range, but having rapid barrel erosion from shot to shot. The suspected Iraqi project might have resulted in a gun that was 134 ft. long, and providing a few hundred miles horizontal range. The stated range figure becomes comparable to that which V-2 and Redstone surface-to-surface missiles achieved in the early years of missile development.

My speculation about there being some connection with HARP were thus confirmed. That 1960's effort at McGill University was mentioned directly. It was said that its leader, Dr. Gerald Bull, had been consulted by the Iraqis in developing the design plan. Also, I was saddened to hear, Dr. Bull was said to have been murdered several weeks earlier. At the time, he had been living in Belgium.

Guns As Satellite Launchers

Guns of various complexions are among the branches of technology relevant to space transportation options.

Generic kinds of gun concepts divide into groups according to differing operating principles. Among these are compressed-gas guns and gun-like electromagnetic mass accelerators. (Being "gun-like" implies a projectile is given a substantial impulse, to a large velocity, all during a small fraction of a second.)

Gas guns have a gas, initially at high pressure, expand down a tube. The gas may issue from a tank, stored for a long period at high pressure. It may be created by exploding "energetic materials," as with conventional artillery. HARP used this.

Final projectile velocity is limited by speed of sound in the gas. Hotter gases improve performance, as do gases having lower molecular weight. Guns may be staged in series. One gun may drive a piston to compress a lighter gas, which then expands down the next barrel, transporting the projectile. Lawence Livermore National Laboratory is investigating "light-gas guns" for use as space launchers. [9]

Electromagnetic guns use electric and/or magnetic field interactions for imparting a momentum impulse to the projectile. Higher final velocities, beyond the speed of sound in any gas, become possible. Light's speed is approached, if the masses are downsized to be only subatomic particles. But big masses interest us here.

One type, resembling an electric motor unrolled, employs low currents in multi-winding coil arrays. Gradients in mutual inductances between coils gives rise to the forces. These often bear the name "mass driver". An alternate term, "coil gun," is now gaining popularity.

Another type uses an extremely intense current. Megaamp arcs travel between charged rails, through armatures (turning them to plasma). Hence they carry the name "railguns."

What Was HARP?

The High Altitude Research Project, run out of McGill University in southern Canada, included the use of cannons formed by putting large naval guns end to end. The scientific use was to launch probes vertically, to make upper atmospheric measurements. Proposed upgrades with added rocket upper stages (or also air-breathing scramjets) would permit small satellites and relatively inert cargo to be placed into orbit, perhaps very inexpensively. [10]

The technique involves a gun with long, large-diameter bore. To reach great altitudes (or ranges), the ballistic coefficient (ratio of weight to product of the area and drag coefficient) needs to be high—over 3000 lb/ft^2. That means the projectile will have a large ratio of length to diameter. In one, 'partial diameter' instance, the round has a substantially smaller diameter than the gun tube. If so, it rides inside a sabot (full-diameter casing), which falls off as the combination emerges into the air. In the other, 'full diameter' instance, the round and bore have similar diameter, not requiring a sabot. Projectiles aerodynamically stabilized with fins, and equipped with rocket motors, were demonstrated in the HARP effort. Propellant was typically a low-explosive material such as guncotton, in order to get muzzle velocity of 4 to 5 times sound speed.

After 5" and 7" guns were tested at Aberdeen Proving Ground, reaching altitudes of over 75 kilometers (47 miles), the McGill group installed a special 16" gun on the island of Barbados. This site was close to the equator and

to U.S. missile-test range optical and electronic tracking facilities.

The modified naval gun was converted to a 16.4-inch smoothbore, and its barrel was extended to 85 calibers. (In artillery jargon, one caliber is the diameter of the gun. Therefore the barrel length was 1394 inches, or 116 feet 2 inches.) Total length was 119 feet, and the gun weighed 180 tons. Rocket-assisted projectiles launched from the HARP gun probed upper-atmosphere winds by squirting luminescent chemicals as they rose. Other payloads, stuffed with high-G electronics, telemetered information on the ionosphere. They routinely reached altitudes of 130 kilometers (81 miles) or more. The gun was capable of sending a 10-kilogram payload to 180 kilometers.

A similar large gun, mounted to fire horizontally, was used for engineering development. It still lies rusting in Highwater, Quebec (presumably nobody has bothered to move it in twenty-five years). Its firing range extended over the U.S. border into Vermont.

The possibility of launching rockets into orbit was studied extensively by HARP's engineers. They designed three-stage rocket shells to be fired from the 16-inch gun. The gun also attracted the interest of high-speed ramjet researchers. [11] It had the capability to launch scramjet (supersonic-combustion ramjet) vehicles weighing 400-2000 lb to Mach numbers 3.3 through 7. "[Trajectory calculations showed that] with a launch speed near Mach 5 and inert mass ration of 0.5, it should be possible to achieve powered flight speeds in the Mach 12-16 range. ...Attainable velocities and altitudes make the gun-launched [scram] jet a good first- stage system for orbital boosting[12]." Unfortunately, the project was ended before it ever attempted to launch payloads into orbit.

From Artillery Genius to Arms Dealer

U.S. News and World Report has termed Bull an "artillery genius." The article by D. Burke during 1985 in Maclean's illuminated the ballistics specialist's background for readers. [16]

Gerald V. Bull was born in 1929 in North Bay Ontario. Canada. At age 21 he became the youngest ever Ph. D. graduated from the University of Toronto's aeronautical engineering department. At Valcartier, Quebec, he worked in a guided missile program. Later, for the U.S. and Canada, he directed (HARP) at McGill University's Space Research Institute, Montreal.

Bull's internationally renowned expertise in heavy artillery technology evolved into his eventual leadership of a multi-million dollar research business. P. and E. Bronfman were persuaded to help privately provide the capital to build a development range in 1968. Until the late 1970's. this company, Space Research Corporation (SRC), conducted research at an 8000-acre compound, of which Dr. Bull was the owner. Straddling the US-Canada border. it was located near Highwater in Quebec and Newport in Vermont.

At one time, Bull was acclaimed as "the man who could make Canada a space nation overnight." The main source for support was defense contracts with the US government. His team then contained 100 scientists, engineers, and technicians. Among the projects of their analysis and experimentation were cannon-launched reconnaissance satellites, artillery shells for intercontinental range, and anti-ballistic-missile (ABM) systems. His most notable invention, according to news reports, was the 155 mm G-5 howitzer, with its long-range pickle-shaped artillery shell.

During 1977, at a news conference in Ottawa, Joshua Nkomo of Zimbabwe told of armaments smuggled from that country to South Africa in violation of the United Nations arms sales embargo. He said the shipment amounted to 900 tons. Transport of 30,000 shell casings for the G-5 were traced to SRC by the police investigation following. A US court sentenced Dr. Bull to a 6-month prison sentence in Pennsylvania when he pled guilty to charges of breaking munitions technology export regulations.

An episode of *60 Minutes* about Dr. Bull and Harp aired some time between 1979 and 1983. It explored the diversion, of the basic capabilities and principles from science, to military artillery for a foreign country. The program implied another disquieting possible connection: A mysterious "double-humped flash" had been detected by satellites, similar to what would be suspected from a low yield, air burst, nuclear test explosion. The supposed culprit may have been South Africa and/or Israel. No nation ever claimed it their own.

Bull had vociferously expressed disagreements with the previous Liberal Party government, for their lack of interest in military spending, in addition to criticism of the Eastern European system. He became unpopular with some civil servants. Combined with his conviction in a US court, this might have motivated the Canadian federal

agencies' punitive responses. They may deliberately been designed to drive his company out of business. Such was the contention of a law suit for damages filed behalf of Dr. Bull and the company. SRC was hit with a $7 million tax bill. It was later withdrawn. But bankruptcy of the company had been triggered.

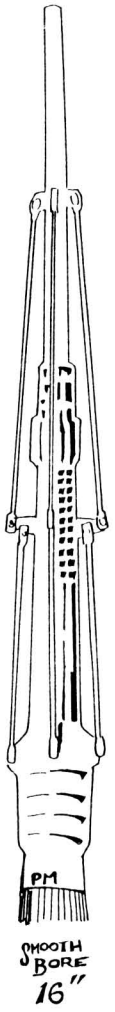
With staff of four, SRC was reestablished in Brussels. By 1985, the consulting engineering firm had rebounded to a staff of 75. Contracts with 10 governments had been obtained.

On 22 March 1990, outside his Brussels apartment, Dr. Gerald Bull was found shot. Untouched, in his pockets was $20,000. According to the *Toronto Star,* "The killing—two bullets to the neck from a silenced 7.65 millimetre pistol—appears to have been the work of a professional.[13]" Suspects in his murder are still unknown, though the *Star* suggested that the both Israeli and Iranian intelligence services might have had a motive: preventing Iraq from acquiring strategic weapons. *60 Minutes* interviewed an Israeli reporter who even speculated that Bull was a double agent for Israel, and was killed by the Iraqis themselves. [14]

Kieran A. Carroll, of the University of Toronto Aerospace Institute, marked Dr Bull's passing with these words: "I can't help but feel that Bull was not an arms dealer entirely by choice. I can easily imagine him as a space enthusiast with a vision for a revolutionary technology, one that could greatly benefit the development of space (by bringing about lowered launch costs), who turned to arms trading as a means of bringing in money to keep his research going."

An epitaph is now owed to him: "The only receptive ears and purses found, as a last resort, were those of foreign armies. The logical users, in Western civil space science and commercial efforts, did not show up to prevent cancelation of the studies upon which a career was built. Ah, temptation!"

End of Part I



References

[1] Newspaper pg. A1 stories, some times as headlines: Thur.2 Aug.1990: *The Philadelphia Inquirer:* Iraqi troops cross border into Kuwait– Reuters news service; *St Louis Post:* Stay Away, Iraq warns; Bush acts to assist Kuwaitis– L.M. O'Rourk *Louisville* (Ky)*Courier Journal:* Kuwait says Iraqi forces crossed border– AP.
Fri. 3rd Aug 1990: *Louisville* (Ky)*Courier Journal:* Only Arab world fail to condemn strike on Kuwait– Terrence Hunt, AP. *Boston Globe:* Iraq tightens its control over Kuwait– Mary Curtis, Stephen Kurkjian

[2] *Baltimore Sun,*"Bush sends US troops to Saudi Arabia," Wed, 8 Aug 1990. A photo, repeated there and several other places. A particular Marine, at top of the air plane boarding gangway, smiling and waving a palm sized flag at onlookers, is shown departing N. Carolina for the Persian Gulf.

[3] 20:30 Fri, 8-18-90 news headlines, WXIX TV channel 19, Cincinnati OH.

[4] Lous Ember, Dugway, Iraq focus of arms concerns, *Chemical & Engineering News*; V66 p8; 26 Sept.'88; Kurds claim Iraq bombed city with typhoid, *New Scientist* V119 p25, 22 Sept.'88; Alan George, Fitting together an Iraqi jigsaw puzzle (Iraqi government bypasses arms embargo and gains access to Western military technology), *The Engineer* (London, England), V269 p22-3, 26 Oct. '89; Iraq believed using chemical arms again, *Chemical & Engineering News* V64 p8, 24 Feb.'86; Louis Ember, Charges of toxic arms use by Iraq escalate (Iraqi- Iranian conflict, 1980-), *Chemical & Engineering News* V62 p16+, 19 March '84.

[5] Robert Duncan Enzmann, consulting editor, *Second Conference on Planetology and Space Mission Planning,* in *Annals of the New York Academy of Sciences,* V163 Art.1, containing pages 1-588, 4 Sept. '69. It discussed such exotic space technologies as HARP, ILRV with drop tanks, Phil Bono's ballistic orbital/global transport (operable in airliner-like fashion), and nuclear light bulb (gas core nuclear reactors) as rockets. (This text was acquired, circa 1976, as University of Louisville engineering faculty weeded their collections. A quick perusal instantly revealed the merit of my practicing techno-pack-rat tendencies in picking up such sources!)

[6] Charles H. Murphy, Gerald V. Bull, Eugene D. Boyer, "Harp Vehicles as meteorological and geophysical probes," pg 276-87; ibid.

[7] Gerald V. Bull (Space Research Institute, McGill Univ., Montreal Quebec, Canada), Charles H. Murphy (Ballistic Research Labs, Aberdeen Proving Ground, Maryland USA)," Gun-Boosted Rockets for High Performance Sounding Missions," pg 581-593, in *AIAA Sounding Rocket Vehicle Technology Specialists Conference,* 27 Feb. to 10 March '67.

[8] *All Things Considered,* National Public Radio broadcast, Wednesday, 4-18-90, WMUB Oxford OH

[9] Breck W. Henderson,"Livermore proposes light gas gun for launch of small payloads," Av. Week, 23 July '90 pg 78-9.

[10] C.H. Murphy, C.V. Bull, "A review of Project HARP," in *Planetology and Space Mission Planning, Ann. N.Y. Acad. Sci.*, Vol. 140, Art. 1, December 16, 1966, pgs 337-57.

[11] N.F. Amin, S. Molder, "Performance comparison of Gun Launched Scramjets for Various Fuels," *AIAA J. of Spacecraft & Rockets,* Aug. 1967, V4 N8, pg 1089-91.

[12] A.M. Valenti, S. Molder G.R. Salter, "Gun-launching supersonic combustion ramjets," *Astronaut. Aerospace Eng.* V1, 24-29, Dec. 1963.

[13] *Toronto Star,* 31 March 1990, p. A13.

[14] *60 Minutes,* CBS News, broadcast 23 September 1990.

LOST LEGACY

Grumbles from the Grave
Robert A. Heinlein
edited by Virginia Heinlein

reviewed by Barry Gehm

In 1973, Robert Heinlein wrote to Lurton Blassingame, his literary agent, that he was at work on "a memoirs-autobiography job to be published posthumously....Working title: *Grumbles from the Grave by Robert A. Heinlein (deceased)*. It's amazing how frank and acidly funny one can be when one is certain it will never see print until the writer is safely out of reach....It will be easy to write--lots of notes, lots of pack-rat-saved souvenirs, more than fifty years of letters, many things I have never discussed--e.g., the frontline seat I had in the crisis many years back with Japan, before World War II...plus a Secret Life of (Walter Mitty) Heinlein, etc."

In her foreword, Virginia Heinlein (RAH's widow) writes, "At one time, Robert wrote to his agent about the possibility of writing a memoir-autobiography: *Grumbles from the Grave* by Robert A. Heinlein (deceased). This is that book."

No, it isn't, unfortunately. That book, as VH reports in an editorial note to the letter quoted above, never got beyond the note gathering stage. Too bad, it sounds like it would have been quite a read.

This book is something rather different. Primarily it is a collection of RAH's correspondence, supplemented by editorial notes and a short biography of RAH by VH, a bibliography, and appendices containing the original versions of portions of *Red Planet* and *Podkayne of Mars* that were modified at the insistence of the original publishers. A fitting coda is provided by VH's account of accepting on RAH's behalf the NASA Distinguished Public Service Medal awarded to him posthumously "in recognition of his meritorious service to the Nation and mankind in advocating and promoting the exploration of space."

The bulk of the book consists of excerpts from the letters of RAH, and the bulk of these are to (or from) his agent, Lurton Blassingame. It is understandable that a any collection of a writer's letters about his writing would include a substantial portion to his agent, but almost 90% of the entries are from correspondence with Blassingame, which seems excessive. I found myself wondering, "did he never write to anyone *else*?" Occasionally he did, and the letters to other correspondents are frequently among the most interesting.

Case in point: the first two chapters ("In the Beginning" and "Beginnings"--the redundancy of the titles is representative of the rather shaky editing: two other chapters are titled "Miscellany" and "Potpourri") consist entirely of correspondence between RAH and John W. Campbell, Jr., (then editor of *Astounding*) during the period 1939-1941. I found these the two most interesting chapters in the book, not least because of the insight they provide into RAH's robust self-appreciation and strong business sense. Between protestations of his warm feelings for Campbell, RAH explains that he will continue to write for him only so long as Campbell accepts every story RAH sends him and no other writer for *Astounding* is paid a higher word rate than RAH. All this less than two years after the publication of RAH's first story! Amazingly, or perhaps I should say astoundingly, despite RAH's demands a genuine friendship appears to have developed between the two men. (Of course, it behooved Campbell to be tolerant: RAH was two of his most popular writers.) Shortly after Pearl Harbor the two men had a falling out over some criticism Campbell had made of the Navy. (RAH had been forced by tuberculosis to abandon his original career as a naval officer but at the time of the letter was trying to get reassigned to active duty.) VH describes their friendship as "another casualty, probably, of World War II," but the eventual clash of two such egos seems inevitable to me, war or no.

The famous Heinlein juveniles are covered in some detail, especially RAH's struggles with the neuroses of Alice Dalgliesh, an editor at Scribner's. Before reading *Grumbles* I had heard rumors that RAH had had trouble with an editor over sex in his juveniles, especially *Red Planet*, which made me wonder whether the apparently increasing preoccupation with sex in his later novels was simply the result of less restrictive editing. The uncensored excerpts in the appendix and the accompanying letters reveal that such is not the case; Miss Dalgliesh would have found dark intimations of bestiality in the relationship between Timmy and Lassie.

The early Heinlein adult novels are also treated substantially, typically with a few pages devoted to each. *Stranger in a Strange Land* unsurprisingly gets the most coverage, with two whole chapters devoted to it. No correspondence at all related to the later novels is included; VH indicates that RAH's ill health caused him to concentrate exclusively on producing pay copy, while she handled correspondence and other business matters. As a result, *I Will Fear No Evil, Time Enough for Love*, and *The Number of the Beast* receive only a few lines apiece in the Afterword; *Friday, Job, The Cat Who Walks Through Walls* and *To Sail Beyond the Sunset* are merely mentioned without any discussion at all. Some people may feel this is actually a good thing, but considering that the later books included some of RAH's biggest sellers and most controversial work, the absence of any significant material relating to them makes the book seem incomplete.

Other conspicuous absences contribute to this sense of incompleteness. For example, there are no letters to or from other science-fiction writers (apart from Campbell in his capacity as editor). Although many of the letters bemoan the amount of time wasted reading and answering fan mail, only one letter to a reader is included. The reader, a member of one of the *Stranger*-based quasi-religions that sprang up in the 70s, wanted to know why RAH was not more supportive of such groups. RAH's reply is one of the most interesting letters in the book, discussing his feelings about not only the *Stranger* cults but also fandom, his work, and his readers. (Incidentally, it contains the *only* allusion in the entire book to the critical studies of RAH by Alexi Panshin: "...I am repeatedly amazed by the number of people who claim to be "experts" on me. (One of them even wrote an entire book about me. I have never met him in my life.)") Surely RAH wrote other letters to readers that would have merited inclusion, if only to break up the monotonous repetition of "Robert A. Heinlein to Lurton Blassingame."

Conversely, some of what is present could have been dispensed with. An entire chapter is devoted to describing the constructions of the Heinleins' various houses, about which the typical reader is unlikely to care much. An item about the Heinleins' kittens and ducks

appears twice, which is about $1\frac{1}{2}$ times more than its interest warrants. "This I Believe," a short essay RAH wrote for Edward R. Murrow's radio program of the same name, also appears twice. Such duplications suggest careless editing.

Heinlein completists and serious students of the genre will definitely want to get this book, but I doubt that casual readers and fans of RAH's fiction will find enough of interest to justify spending $19.95 buying it and several hours reading it. It's hard to believe that this is the most interesting book that could be assembled from RAH's letters and papers.

Ask Dr. Techie

Saline Nation

Barry Gehm

Mary Lynn Skirvin Johnson asks:

In the movie and TV series *Alien Nation*, we are told that the "Newcomer" aliens cannot go in or near oceans because salt water is highly corrosive to their bodies. However, we are also told that the aliens like to engage in sexual activity with humans and consume raw meat from terrestrial animals.

Now, I have heard that blood is largely composed of substances that are nearly the same as those found in seawater. My questions are: are seawater and blood (or human skin secretions) really *that* similar? If so, do they differ significantly enough that *both* situations could exist? In what ways *do* they differ?

Once again Dr. Techie has fallen victim to his insistence on control experiments. He was arrested on a pier in Los Angeles for accosting people, offering them steak tartare *and an indecent proposition, then pushing them into the ocean. Unfortunately, the* Pyro *budget was insufficient to cover his bail, and in his absence the question was referred to Dr. Barry Gehm....*

Questions about sf? People are going to think this is a fanzine.

Obviously, the similarities between blood and seawater don't extend to the cells, proteins, or nutrients that blood contains: seawater is pretty low in hemoglobin. In terms of their ionic composition (that is, the dissolved salts), there is a strong similarity. For starters, the major salt in each one is sodium chloride (NaCl), ordinary table salt. When salts dissolve in water, the ions separate, so the major positive ion in both seawater and blood is the sodium ion, Na^+, and the major negative ion is the chloride ion, Cl^-. The other significant positive ions in both seawater and blood plasma are potassium (K^+), calcium (Ca^{2+}) and magnesium (Mg^{2+}). The other significant negative ions found in both are bicarbonate (HCO_3^-), sulfate (SO_4^{2-}) and hydrogen phosphate (HPO_4^{2-}). Qualitatively, then, the ionic compositions of blood plasma and seawater are pretty similar. There are some quantitative differences, however.

For one thing, seawater is saltier than blood plasma. The total concentration of dissolved salts is about $3\frac{1}{2}$ times higher, which accounts for the dehydrating effect of drinking seawater. For another, the proportions of some of the ions are different. Seawater contains a higher proportion of sulfate and magnesium ions than plasma, and less bicarbonate. Of course, seawater and blood plasma contain many trace elements, but these are in such low concentrations that we can ignore them for this discussion. Also, some of the ions in blood plasma are organic ions that aren't present to any significant extent in seawater.

None of these differences seem to offer any plausible rationalization for the extreme sensitivity of the aliens to seawater given that they don't seem to be bothered by mammalian blood (in raw meat) or human sweat and semen (which have ionic compositions similar to blood plasma). In the movie, two aliens are killed, almost dissolved, by immersion in seawater, and the alien police detective suffers painful burns on his hand from reaching into seawater for a few seconds to help his drowning partner. The effect of seawater on aliens is compared to that of hydrochloric or sulfuric acid on humans.

Seawater is not acidic; like blood plasma it is slightly alkaline. The possibility that alien biochemistry is very alkaline, so that seawater is like an acid to them, seems to be eliminated by the aliens' drinking of sour milk, which is much more acidic. Also, a billboard touting Pepsi (which is also quite acidic) to the aliens is shown in the movie. Conversely, the possiblity that seawater is too alkaline for the aliens also seems implausible, given their tolerance of human food and body secretions.

Furthermore, seawater is not very concentrated. Even if all the salt in seawater were converted to hydrochloric acid, it would still be less than one-tenth as concentrated as the "dilute HCl" used in chemistry labs. You could easily dip your hand in it without suffering any harm. Ditto for converting the salt to an alkali like sodium hydroxide (lye), although you would want to rinse your hand off afterwards.

Still, seawater is more concentrated (that is, saltier) than our precious bodily fluids, which does raise the possibility of an osmotic effect. When cells are immersed in a liquid that has a higher concentration of dissolved substances than is present inside the cells, water diffuses out of the cell by osmosis, and the cell shrivels until its internal concentration matches the external. If the difference is too extreme, the cell will die. The relative impermeability of your skin keeps that from happening to you when you go into the ocean, and you have other defenses as well. If the aliens had very, very poor osmotic defenses, seawater might destroy their tissues, but it is hard to imagine any form of land-based life having such poor osmotic control: being exposed to dry

air has the same effect. More to the point, such organisms would be even more vulnerable to *fresh* water, which would make their cells swell up and burst.

In short, you are right in thinking that dissolving in seawater is implausible given the aliens' compatability with human and animal bodily fluids. By the standards of movie and TV sf, though, it's not a very big implausibility. Ask me about Mr. Spock sometime....

Classified Ad

WANTED: INFLATABLE PTERODACTYL, wingspan as large as possible (the one with the 15-foot wingspan would be wonderful). Please send info to Clyde R. Jones, P.O. Box 1099, Waukegan, Illinois, 60079-1099. No sheep. Thranx.

Or Would You Rather Be A Fiche?

John Zube

I wonder whether your group of fans ever tried to have fun by micrographic doings, i.e., self-publishing rare titles, titles which are not copyrighted or no longer copyrighted, on microfiche. That could be easily done through a micrographic service bureau, at unit prices which almost anyone can afford. A book title, for the master and the first hundred microfiche duplicates, costs only about $50.00. On the fiche duplicates the price per page can come down to 0.04 cents.

Automatic cameras at the service bureaus can "scan" up to 800 documents a minute, much closer to fault-free than the best scanners now in operation, and COM-fiche machines and ordinary automatic fiche duplicators can produce a fiche of (in my case) 98 to 745 pages in 3 to 6 seconds—much faster and cheaper than the fastest laser printers could. 2000 fiche fit into a shoebox. Six can be sent as an ordinary letter.

The possibility of microfilm libraries has been mentioned in science fiction hundreds if not thousands of times—but so far only very few SF fans have *done* anything about this. This in spite of the fact that some full back files of SF magazines are available, at affordable prices, only in this format; in spite of the fact that NASA and National Technical Information Service, Alternative Technology Library, Survivalists, and others have produced an enormous quantity of literature in this medium. Altogether there may be now more material *permanently* in print on microfilm than is *temporarily* in print on paper.

Printing is still, in spite of technical refinements, basically a 500-year-old technology and has remained very expensive. Consequently, most writings never saw print and those who did were often published only once or went often for long times out of print and are not readily accessible to all people everywhere.

Used fiche-reading machines are available in most cities from as little as $50-100, the price of many printed modern textbooks. Large libraries have already up to 25% of their titles on microfilm and the back issues of about 75% of scholarly journals have been microfilmed. Some large microfilm publishers, like Interdoc, offer millions of titles in this format.

SF fans should have been in the forefront of using and publicizing this medium, even if only within small fannish circles. "How fertile even the smallest circle can be—if it is well utilized!" said Friedrich Schiller, long ago. If, for example, fifty SF fans could be won over to publish annually 70 fiche, as I do, very comprehensive collections of older SF writings, or of hitherto unpublished manuscripts, could soon be built up.

Imagine establishing a micrographic manuscript publishing center that could declare: *We publish on microfiche* all *manuscripts whose publication would not lead us into jail, provided only you pay the minimal filming and listing costs involved.* If you wanted minimal advertising and library circulation, that would be x dollars more. For y publicity and z library distribution it would cost so-and-so much. What creative energies could be thus publicly released and be permanently and affordably available on demand!

Micrographics is already integrated with electronic technologies and is likely to remain efficient in its niche: hardcopy, affordable and simple technology; much as handwriting, duplicating, typing, books, and offset printing are still with us and are likely to be for a long time to come.

In short, I appeal to you to do your bit to help enlighten the fannish circles—to the long-term benefit of yourself and all others. I would gladly supply more information if you are interested.

John Zube is an ardent libertarian and microfiche publisher with over 850 fiche in print. Write him for a list of available publications, and if you have any special interests (we know he's big on libertarian books, SF magazines, and SF criticism, for example), mention them. He can recommend good microfiche readers, too. Seems to us that enclosing a self-addressed envelope with overseas postage would be polite.

7 Oxley St. Berrima, NSW 2577 Australia Telephone (048)771 436

PyroTechnics
The Now & Then Newsletter of General Technics

Published Quarterly

Mismanaging Editors	Bill Higgins Dr. Barry Gehm
Classified Ads	Sam Paris
Mailing List	Dave Ifversen
Madam Mailbox & Reprowoman	Mary Lynn Skirvin Johnson
Treasurer	Connie Trembley
Director, Advanced Systems Division	Bill Leininger
Layout	Paul MacNerland & Dawn
Dominatrix	Mary Lynn Skirvin Johnson

Small Print Department

PYROTECHNICS is a publication of General Technics and, (while not copyrighted by one individual), is copyright© 1990, by the individual contributors. All rights ARE reserved. All rights revert to those contributors upon publication. Uncredited comments can be assumed to be from one of the following individuals: Bill Higgins, Barry Gehm, Sam Paris, Bill Leininger, or Mary Lynn S. Johnson. The ideas and opinions expressed in PYROTECHNICS are those of the individual writers, and do not necessarily reflect the views of the editorial staff, General Technics, or the Universe.

Subscriptions
are available at $4.00 for four issues (includes one free - classified ad), $5.00 from Canada, and $9.00 internationally. Maximum subscription length: 8 issues. Amounts are payable in US dollars or International Reply Coupons (available at your local post office).

Please make all checks and money orders payable to Constance Trembley, and write 'PYRO' somewhere on the check (in the notes field, or wherever. Thanks.)

Advertising Rates
A free classified ad of 100 words or less is included in the cost of a four issue subscription. Quarter page ad - 4 1/4 inches wide by 5 1/2 inches tall, camera ready = $8.00. Half page ad - 5 1/2 inches tall by 8 1/2 wide, camera ready = $15.00. Full page ad - 8 1/2 inches tall by 11 inches wide, camera ready = $30.00. Please remember to leave a quarter inch white border all the way around your ad or we will reduce it to fit. Fees for ads are non-refundable. Purchasers of 1/4, 1/2, or full page ads need not be subscribers and will receive a free copy of the issue their ad appeared in.

Submissions
PYROTECHNICS gleefully accepts contributions in the form of art and articles. If at all possible, text should be formatted 5 inches wide and justified. PLEASE! If you go to the trouble to format it, make sure that your finished copy is BLACK. Disks are also acceptable if you do your text as an IBM, MacIntosh, or Atari (8 bit) file.

Contributions of art can consist of cartoons, fillos, photos, etc. We prefer good black photocopies to original art.

All contributors will receive a free copy of the issue they appeared in, and if that contributor is a subscriber, then the subscription is extended by one issue.

PYRO would also like to retain reprint privileges on all contributions. If you have any serious objections to this, let us know before we print your material. (Reprints of earlier issues are made and sold to help pay for larger issues, half tone reproduction, etc.)

Any material sent to PYRO will not be returned unless accompanied by a self addressed, stamped envelope. All correspondence should be addressed to:

PyroTechnics
P O Box 965
Aurora, Ill
60507

While Mary Lynn receives the mail, she might not be the one to answer it. Please specify if you need an immediate reply.

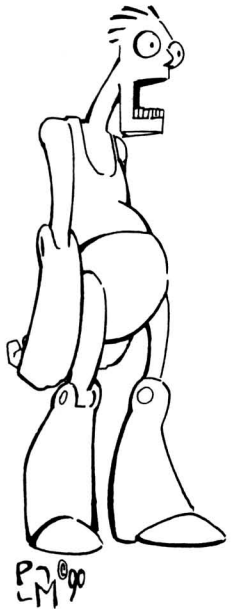
Deadlines for the next few issues are as follows
#48 - Feb. 3, 1991
#49 - May 3, 1991

IMPORTANT!! IMPORTANT!!!

We've had a few people who've reported back that they are not recieving their PYROs. However, in order for Dave or Mary Lynn to trace the problem, you must send us your correct address as well as a list of the PYROs you have RECIEVED since issue #39.

Without this information, we'd be guessing at best as to what the cause of the problem might be. Please remember to let us know as soon as possible when you have a change addresses and be sure to check your address on the mailing labels for possible typos. If you find a problem, or know of someone who has one with PYRO delivery, please drop us a line at the PYRO PO Box. THANKS!!!!

PyroTechnics
P O Box 965
Aurora, Ill
60507



JOHN RIDLEY
406 2ND
HOUGHTON, MICH.
49931

3 ISSUES LEFT

First Class Postage

GENERAL TECHNICS